

# Canadian Forest Genetic Resources Information

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## Abstract

A knowledge management prototype, called the *Canadian Forest Genetic Resource Information System (CAFGRIS)*, was developed to integrate and synthesize relevant spatial and non-spatial data for assessing, reporting, and making decisions on the status and management of native tree species. This prototype includes a mapping component that shows the distribution of specific species and offers a number of overlay options, such as ecozones, current and historical burn areas, and the location of seed stored by the Canadian Forest Service's National Tree Seed Centre. The prototype also incorporates a variety of species-specific information, including text pertaining to the biology and ecology of native tree species, threats to these species, and results from a survey to identify native tree species that may be in need of gene conservation measures. The goal of this prototype is to be able to provide information concerning native tree species and their current conservation requirements.

## Résumé

Un modèle de gestion des connaissances appelé *CAFGRIS (Canadian Forest Genetic Resource Information System)* a été élaboré dans le but d'intégrer et de faire la synthèse des données spatiales et non spatiales afin d'évaluer le statut et la gestion des essences indigènes, d'en faire le rapport et de prendre les décisions qui s'appliquent. Ce modèle comporte une composante de génération de carte présentant la distribution d'espèces spécifiques ainsi qu'un certain nombre d'options de superposition telles que les écozones, les secteurs de brûlage actuels et passés et les lieux d'entreposage des semences du Centre national de semences forestières du Service canadien des forêts (SCF). Le CAFGRIS contient également une série de renseignements spécifiques à certaines essences, dont des documents portant sur la biologie et l'écologie d'essences indigènes, les menaces contre ces essences, et les résultats d'un sondage signalant les essences indigènes qui pourraient nécessiter des mesures de conservation des gènes. L'objectif de ce modèle est d'arriver à fournir de l'information sur les essences d'arbres indigènes et sur leurs besoins de conservation actuels.

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## Introduction

Canada—with about 41% of its land area covered with forest (Natural Resources Canada 2006)—is a forest nation. Its forests face a variety of threats, such as climate change and invasive alien species. An estimated 140 000 species, including plants, animals, and micro-organisms reside in Canada, two thirds of which are found in forests. Given the size of the forests and their diversity, obtaining an overview of how individual tree species in Canada are tolerating the various threats is challenging.

Genetic diversity enhances forest species' ability to tolerate these threats. Genetic diversity is the variation among genes either within individuals of the same species or between species. It is essential: 1) for adaptation to changing environmental conditions, including climate change, changes in air quality, and invasive alien species and 2) as a source of new variants of potential economic value to forestry.

We are in the process of developing the Canadian Forest Genetic Resource Information System (CAFGRIS), a knowledge management system that will provide information concerning forest genetic resources. The CAFGRIS is deployed through the National Forest Information System, which is an initiative of the Canadian Council of Forest Ministers (CCFM).

The purpose of CAFGRIS is to gather, integrate, and synthesize digital information, thereby generating new knowledge concerning native tree species and threats to these species. The prototype includes both spatial and non-spatial information. The system adheres to the Canadian Geospatial Data Infrastructure standards and principles, and international standards such as the Open GeoSpatial Consortium, which allows us access to various data sources—including U.S. geospatial data (e.g., species' distribution maps)—that would otherwise be inaccessible. As well, through the use of the CFSNet infrastructure, we are able to ensure that the information is accessible, current, and authoritative.

To date, we have released a prototype that contains information regarding the biology and ecology of native tree species and, where applicable, the threats to these species. Each tree species has a designation generated through a survey conducted by the Canadian Forest Service (CFS) that assessed the conservation requirements of native tree species. The official federal Species at Risk Act (SARA) designations and provincial or territorial designations are also included with supporting documentation. Information pertaining to *in situ* conservation is included, specifically the identification of protected areas, of which Canada has over 2800 (CCFM 2006). Information pertaining to *ex situ* conservation is also available for individual species. The CAFGRIS presently includes data from the CFS's National Tree Seed Centre, and will eventually include information from other *ex situ* collections from across the country.

## Gene Conservation Survey

A survey was conducted in 2003 to identify native tree and shrub species that may be in need of gene conservation (Beardmore *et al.* 2006). This survey was initiated by the steering committee for the CFS's National Forest Genetic Resources Centre, which includes the National Tree Seed Centre. It was recognized that several provinces are actively pursuing programs to identify species requiring gene conservation measures. The purpose of this survey was not to duplicate on-going conservation efforts, but to: 1) provide a perspective on what the tree and shrub gene conservation needs are across the country, 2) identify areas in which more work can be done, and 3) assist the National Tree Seed Centre in identifying species for their *ex situ* gene conservation collections.

The survey contained a preliminary list of native tree and shrub species. Before sending out the survey, we identified, based on available information, those species that might require gene conservation measures using a set of criteria developed in an earlier process that included information from the Conservation Data Centres, provincial and territorial departments, and the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). These criteria were: 1) species rarity; 2) lack of or uncertain viable seed source; 3) serious threat from an exotic disease or insect; 4) serious threat posed by environmental change; 5) species' regeneration threatened by certain harvesting practices; 6) substantial decrease in the range or frequency of the species; 7) high demand for other uses for the preferred habitat of the species; 8) high demand for the species for a special purpose; and 9) threat to species posed by hybridization or introgression. If any of these criteria applied to a species, it was then rated according to the following values:

- 0 – No apparent cause for concern
- 1 – Species may need attention, but there is incomplete information
- 2 – *In situ* conservation measures are required, e.g., specific management practices or inclusion in protected areas.
- 3 – *Ex situ* conservation measures are required, which may involve storage of germplasm, e.g., seed.

The survey was sent to experts at various agencies, and 30 people responded. Participants were asked to comment on the conservation needs of a list of species native to their respective geographical regions. In particular, we asked them to comment on the tentative criteria and rating values that were assigned to each species and to add any species that require conservation, but were not listed.

Results of the survey showed that, of the 124 tree species native to Canada, 77 tree species (18 coniferous and 59 deciduous) were identified in at least one province or territory as requiring either some level of gene conservation or additional information to determine whether conservation efforts are required (Beardmore *et al.* 2006). *Ex situ* conservation measures were recommended for 47 species, whereas *in situ* conservation was recommended for 20 species, and 10 species may need attention but there is insufficient knowledge to make a designation.

Many of the species identified in the survey are under pressure in only a portion of their range. The following species were identified as requiring conservation measures throughout their range because they are threatened by an exotic pest that could cause high mortality: American chestnut (*Castanea dentata*)–chestnut blight (*Cryphonectria parasitica*); beech (*Fagus grandifolia*)–beech bark disease (*Nectria coccinea* with *Cryptococcus fagisuga*); butternut (*Juglans cinerea*)–butternut canker (*Sirococcus clavigignenti juglandacearum*); three elm (*Ulmus*) species–Dutch elm disease (*Ophiostoma novo-ulmi*); and five ash (*Fraxinus*) species–emerald ash borer (*Agrilus planipennis*). Overall, the survey indicated that there is a clear need for a concerted and coordinated effort to conserve species and populations across jurisdictional boundaries before they receive official risk designations through the SARA. This survey information provided the basis for CAFGRIS.